



AVIATION FUEL, DIESEL FUEL, AND GASOLINE

Specifications and Testing

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ASTM INTERNATIONAL

- Committee D02
- Petroleum Products And Lubricants
- Established 1904
- 1560 World Wide Members
- 53 Countries
- Over 600 Standards



SPECIFICATION STANDARDS

- D1655-03a - Specification for Aviation Turbine Fuels
 - D910 - Specification for Aviation Gasolines
- D975-04a - Specification for Diesel Fuel Oils
- D4814-03a - Specification for Spark-Ignition Engine Fuel



TYPES OF STANDARDS

- Specifications (D4814)
- Test methods (D86)
- Practices (D4057)
- Guides (D6074)
- Classifications (D6046)



STANDARDS OUTLINE

- Scope
- Referenced Documents
- Summary of Test Method
- Significance and Use
- Apparatus
- Materials and Reagents
- Procedure
- Calculations
- Precision and Bias
- Annex (mandatory)
- Appendix (non-mandatory)

AVIATION FUEL BULK PROPERTIES

**Major change in composition
(1 to 10%) for significant
change in property**



BULK PROPERTIES

■ Volatility

- Vapor Pressure
- Distillation
- Flash Point

■ Low temperature Operability

■ Combustion Characteristics

■ Density

■ Specific Energy

- Gross Heat of Comb
- Net Heat of Comb



AVIATION TRACE FUEL PROPERTIES

Minor Changes (less than 1%) will cause
significant change in properties



TRACE PROPERTIES

- Oxidation Stability
 - JFTOT D3241
- Water Separation
 - Surfactant D1094
- Cleanliness
 - Particulate Contamination D2276
- Compatibility
- Sulfur D2622, others
- Mercaptans D3227
- Copper Corr D130
- Silver Corr IP227
- Aromatics D1319
- Electrical Conductivity D2624



OTHER PROPERTIES

- Water Solubility
- Microorganisms
- Saybolt Color
 - D156 manual
 - D6045 auto tristimulus
 - Clear and Bright D4176
 - White Bucket Test
- Existent Gum D381
- Lubricity D5001 Ball On Cylinder Lubricity Evaluator
- Aqua Glow D3240
 - 1 -60ppm water
- Thermodynamic Properties



ADDITIVES IN JET FUEL

- Anti Oxidants max 24.0 mg/L
- Metal Deactivators max 5.7 mg/L
- Electrical Conductivity max 3mg/L
- Biocides
- Other anti oxidants and inhibitors
- Anti Icing
 - Diethylene Glycol Mono Methyl Ether

DIESEL FUEL BULK PROPERTIES

- Distillation D86
- Density D1298, D4052
- Viscosity D445
- Heat Content D240, D3338, others
- Cloud Point D2500
- Pour Point D97



DIESEL FUEL TRACE PROPERTIES

- Copper Corrosion D130 max 3
- Flash Point D93 min #1 38C, #2 52C
- Elec Conductivity D2624 25ps/m
- Water Shedding D1094
- Lubricity D6079 High Frequency
Reciprocating Rig scar size specified



OTHER PROPERTIES

■ Cetane Number D613

- #1 and #2, min40, #4, min 30

■ Cetane Index D976, D4737

■ Volatility D86

- 90% distilled #1, 288C #2, 338C

■ Sulfur D2622, D5453, others

- #1&2 Low S, 0 .05%, High S, 0.5%, #4, 2.0%
- Ramsbottom Carbon D524 #1, .15%, #2, .35%
- Oxidation Stability D2274, 1.5% mg/100ml

LUBRICITY

- One fluid having the same viscosity as another, but producing less friction between moving parts has better lubricity
- Low Sulfur Fuels Need Lubricity Additive
 - Linoleic acids: Paradyne 665 Paramins 631
- High Frequency Reciprocating Rig, D6079
- Ball on Cylinder Lubricity Eval, D5001
- Scuffing Load BOCLE D6078

GASOLINE RELEVANT ISSUES

■ Octane

- Engine Manufacturer, Gasoline Marketer

■ Volatility

- Vapor Pressure, Manual D4953, Auto D5191
- Distillation, Auto or Manual D86
- Vapor/Liquid, Manual D2533, Auto D5188

■ Driveability Index

- $D.I. = 1.5T_{10} + 3T_{50} + T_{90}$ Evap Temps by D86



GASOLINE ISSUES (cont'd)

- Oxidation Stability
- Oxygenates
 - Methyl Tertiary Butyl Ether
 - Ethanol
- Sulfur - 10ppm coming to many countries
- Additives - injectors, valves, comb chamber
- Regulatory Action - air Q, renewable fuels